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HUMANISM AND SCIENCE*

Robert L. Sinsheimer**

The most common view of the relation between humanism and science is that the two elements are antithetic. In my view humanism and science are complementary. And indeed I believe that in the last analysis each includes the other—which is not to say they are identical. But this antithetic view has a long and I suppose distinguished history dating back to virtually the very beginnings of modern science.

One need only recall Blake's famous line 'May God us keep/from single vision/and Newton's sleep' through Wordsworth's 'Sweet is the lore which nature brings:/Our meddling intellect/Mis-shapes the beauteous form of things:—/We murder to dissect.' And on to Snow's two cultures and Roszak's critique of science as a 'monster of meaninglessness' and his distinction between information and knowledge or, as he calls it, gnosis.

On the other side the attitude, I fear, has frequently been less one of antagonism than one of condescension—an attitude that the humanities were perhaps pleasant diversions, but irrelevant to the real issues of enduring importance; that the humanities lack intellectual rigor and authenticity; even going so far as to say, in a quote attributed to Bronowski by Roszak, that the artistic response to nature is 'a strangled, unformed and unfounded experience.'

But what are the origins of these postures? I do believe that there is a significant dichotomy in the perceptions of the practitioners of the two disciplines. The humanities and the sciences both represent projections of the human mind, ways in which the human mind seeks to encompass the human experience. But they emphasize quite distinct aspects of that experience.

The humanists are concerned with the world of man and particularly with those qualities that are *peculiarly* human—speech and language and the associated arts of literature, drama, poetry, history; with the esthetic and the artistic and the visionary; with logic and reason and with the human gift of anticipation and its corollary burden of decision and value judgments; and with those feelings that are peculiarly human—compassion, hope, wonder and awe, doubt and grief and regret, rapture and love.

On the other hand the sciences are concerned with the world of nature, and when they do consider man, they are then most interested in those aspects that link man to the rest of nature—to the world of physics and chemistry and particularly biology; that is, the sciences are concerned with man's most general qualities, not his specifically human qualities.

Oddly, the humanities have almost never included science itself as a peculiarly human achievement. It is only very recently, and as yet very seldom, that historians have become interested in the history of science, that playwrights have found drama and conflict in the lives of scientists, that philosophers have pondered the logic of scientific discovery, that aesthetes have recognized the imagination and creative artistry in the scientific ordering of human experience, that essayists have been concerned with the effects of the social

milieu upon the origins and directions of science, that novelists have portrayed the human consequences of life in a technological society based upon principles incomprehensible to most men.

It is also odd that the humanists are not yet keenly alert to the insights into the origins of human qualities that are beginning to emerge from the developments in the neurosciences, that those interested in aesthetics have not yet reflected deeply on the significance of the specific modes of analysis of visual input common to primates, that the logicians have not yet reckoned with the limits to logic that may be imposed by the structures of the human brain.

Perhaps, because the humanists focus upon the peculiarly human, it is not surprising that they eschew—and even resent being reminded of—man's biological bases. They resist and find distasteful the concept that we too, like other creatures, are in very considerable part the product of our genes; that our human faculties must arise in a programmed way in the development of each individual, and that these faculties must be the consequence of an evolutionary, pre-human history.

From the beginning the humanists have deplored what they regard as the exaggerated emphasis which the practice of science confers upon one human quality—what we may call the cerebral, Newton's single vision; at the expense of other human qualities—the sensual, the aesthetic, the emotional, the visionary.

And today when science and its child, technology, have in a seemingly inexorable manner become the driving forces, the engines of our social system, the concern of the humanists has enlarged from the purely intellectual arena to spread an alarm throughout society—to challenge the course upon which science and technology have subtly led us.

The humanists warn of the dehumanization of man in the technological society through the glorification of certain qualities, the cerebral and the analytical, at the expense of the emotional, the sensual, the holistic. They warn of the dehumanization of man through the estrangement of man from nature—his displacement from the natural environment in which man arose, to this technological society that seems to have its own imperatives for which man may or may not be adapted.

They warn of the hubris of wielding powers beyond human scale, of the danger not only of overt nuclear catastrophe, or of the other 'white coat horrors'—the more subtle but foreseeable possibilities of a breach of the ozone layer, or the triggering of a new ice age, or the creation and escape of a lethal virus—but also of the hidden hazards latent in the burdens that a technology may place upon a society. They warn thus of the dangers in a nuclear technology that will produce wastes that must be sequestered for 25,000 years, an 'unforgiving' technology that is woefully subject to sabotage or terrorist subversion. Indeed, from this perspective one can, for perhaps the first time, conceive the specific reality of the Faustian bargain—that science could indeed wholly innocently and inadvertently lead us into a deadly trap.

The humanists warn, and it is most fitting that they do, of the possible consequences of scientific intervention in man himself. What may be the effects upon the *peculiar* qualities of man of behaviour modification, or more ultimately, of human genetic engineering?

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The humanists thus challenge many of the trends of our time, and they place the responsibility for these dangerous courses upon a runaway science and technology, heedless of human values, deaf to the voices of despair.

And what of science now in our time? What response do the scientists make to these charges? Where does the scientist stand with respect to the human and social consequences of his work? The traditional posture of science has been that of a lofty reverence for knowledge for its own sake, with the implicit assumption that knowledge is preferable to ignorance and with the faith that the net consequences will be beneficial. For most scientists, that is still the shield they raise. This posture may have flexed to some small degree, not so much with respect to science *per se* as with respect to technology, the application of science. Even this slight bend is grudging—in part, a consequence of self-discovery; in part, or persuasion; in part, perhaps, even of compulsion.

By compulsion I mean simply that science has become expensive. And the scientist has been compelled to recognize that society must be persuaded, for one motive or another, that the support of science is worthwhile or else science will cease. By persuasion I simply mean that intellectually the alarms of the humanists cannot wholly be ignored.

Most important, because most convincing, is the change in some degree in the self-image of the scientist himself—in his self-discovery. In part, it is a simple consequence of the fact that he too must live in the society his discoveries have helped to shape. In fact, of course, he is far better equipped than most to live in this society, for he understands more of the underlying principles of technology. But he too must endure pollution, he too must share the fear of sudden annihilation, his children too must cope with alienation and all the moral confusion engendered by swift change.

And there is, in some quarters, a growing recognition that by the means of science the balance between man and nature has perceptibly shifted, so that once innocent human ideals boldly proclaimed in the age of human impotence are now seen to be less noble when, even partially, the ideal becomes reality.

This is a curious and sobering twist.

Even Francis Bacon would surely have wondered at this turn of events, though he saw most clearly the potential latent in science, the power inherent in what we would today call the disciplined imagination, trained to look back as well as forward, to test its vision again and again against established knowledge and designed experiment. Three and a half centuries ago, Bacon wrote: 'The roads to human power and human knowledge lie close together and are nearly the same . . . Now the empire of man over things depends wholly on the arts and sciences for we cannot command nature except by obeying her.'

As an aside, there is an interesting, implicit assumption in this statement. For Bacon it was clearly man's prerogative to 'command' nature; he sought only the means. In this, of course, he was but an heir to the Western tradition upon which, in fact, he sought only to improve. A more passive life style—a life of coexistence within nature, as in the Taoist or Navajo tradition—would have been wholly foreign to him.

In Bacon's time man's power 'over things' was so cruelly limited. Afflicted with plague, cursed by want choked with superstition, men must have felt that any increment of knowledge, any enlargement of human control over human destiny, seemed desirable—a change for the better. And Bacon foresaw science as the means to enlarge human knowledge and human power. In fairness, though, one must point out that the Baconian vision of the power of science, while wholly correct in principle, was far too limited in scale. He could, of course, hardly have conceived of hydrogen weapons or genetic engineering.

Today, three and a half centuries later, we have achieved a deep understanding of, and very considerable control over, the natural universe. We have learned to command nature by obeying her. And today we are also learning that with command comes responsibility and the necessity for choice. And the necessity for choice brings science abruptly to those

issues with which the humanists have always been concerned—the definition and ordering of values.

Today we have, increasingly, choices to make about the introduction and the directions of our ever-changing technologies. And thus we have need of the knowledge and insight and wisdom of the humanists to help to guide those choices. In retrospect we can see that our continuing Baconian compulsion to introduce technical and social change has stretched the very fabric of our society and thereby exposed the concealed, yet unhealed, divisions—the ancient and continuing social faults that had been discreetly papered over, the sores of imperialism and racism, and economic injustice.

We can see that very likely particular technologies are better adapted to particular forms of social structure. In the past, we have perforce adapted our social structure to the available technologies. Can we now begin with our wealth of knowledge to reverse this pattern, to construct technologies suited to the society in which we wish to live and the kind of man we wish to be?

Or are we, again, naive? Do we really have the freedom on this small planet to choose our technology? Is there a technological imperative, an innate entelechy that determines the course of technological evolution for which men are the unwitting pawns, much as the cells in a developing organism?

But at least a few scientists can see that we will need all of the wisdom we can muster. Indeed, we have so long been committed to the doctrine that change is, *per se*, good that we lack even the social agencies to brake or divert change. If, as an instance, we should decide that we do not wish at this time to exacerbate our existing social tensions with the introduction of a new technology, such as human genetic engineering with its imperative of difficult and divisive new value judgments, how could we divert it? If we choose to defer this technology, to what time? If we wish to ban this technology, how would we do so, globally—and at what social and spiritual cost to science and to all intellectual zest?

We need humane wisdom if we are to find noncatastrophic solutions to our growing dilemmas. We cannot simply abandon our technological craft—our life-support systems. Our very food and water and warmth depend upon them; there is no going back. Nor really, would we, if we could. Without science and technology we would still be living in the 17th century. Would anyone really take that return trip? Science has brought us wonderful, if troubling, illuminations. Technology has brought us great freedoms, even if it has also brought new torments. Agreed, we cannot continue simply to rely upon more technology to cure the evils of today's technology. We need the insight of the humanists. But also we must have the elixir of science and the thrust of technology.

While there are many points of contact between the humanities and the sciences, human genetic engineering is their direct intersection. The mere possibility of such a technology presents clear imperatives to both disciplines. The humanist must finally recognize that many of our peculiarly human qualities are, in fact, shaped by our genes—yes, by those tiny molecules, that were in turn shaped by eons of evolution. And the scientists must finally recognize that to reshape man is not a beguiling laboratory experiment, but an enterprise that involves the ultimate exercise in value judgment. It is to fuse means and ends; it is to test the validity of all values. To use our heritage to change our heritage is to take the full responsibility for human destiny. The potential of human genetic engineering will draw science into the mainstream of the humanities and the humanities into the mainstream of science—a most fateful union.

If we need, somehow, to blend the humanities and the sciences to cope with the problems of the modern world, how shall we go about it? How can we train individuals to be perceptive of the best of both disciplines? I will not presume to answer for the humanists. From my side I would ask, how can we train scientists to be concerned not only with science itself but also with the definition of the proper role of science in the human adventure? How can the scientist, necessarily deeply committed to his own work, learn to stand back from that work—to see that the world of science is not all-embracing but is one world, contiguous to other worlds?

To see that the scientist is one facet of the human being and to see the relation of the world of science to those other worlds? To stand back and see that science exists because man—alone, so far as we know, among the animals—has the capacity to create within his cerebral cortex detailed representations of his external world, as he perceives it, and to rearrange these representations in varied modes? To see that man presumably acquired this odd talent because of the advantage it gave him in the projection of future circumstances, an obvious aid to adaptation and survival?

And to see then that the price of this capacity, the price of imagination itself, is the potential for distortion, for self-deception, even for hallucination? And that Bacon outlined science then as a reflective art—as a social compact to lead us, through the regimen of experiment, to a single, communal, openly validated perception of the universe? And to see that science is in this sense in some ways like a religion, it requires of its faithful a self-abnegation, a submission of one's individual idiosyncratic view of the universe into the single common, cumulative perception?

This is the way the world is. No less—and no more.

But then also to see that science cannot deny the human *value* of other perceptions of the universe within the human cerebral cortex—of the aesthetic perception or the moral perception or even the fictional perception, if they are recognized as such?

No scientist, only an artist, could produce fantasies that delight us by the rearrangement of the real world (Fig. 1).

No scientist, only leaders with great moral insight, could have devised the basis of our Judeo-Christian ethics.

Nor should science claim even its own perfection, for science is self-evidently a human creation. Science exists in the human mind, and one thing we do know that Bacon could not is that the universe is far more complex than even the human brain. We do marvelously well with our abstractions and our generalizations of reality, but the true external complexity surely greatly exceeds our inherited cranial capacity.

But do we train our scientist thus? Alas, not so. It is true that our great schools of science and technology pay lip service to the humanities but not much more. At the California Institute of Technology (Caltech) it is loosely said that each student must devote 20 percent of his course time to

the humanities, but in fact only one-fourth of that need be in the humanities per se. The remainder can be, for example, economics, social science, or anthropology—all valuable in themselves, but not truly the humanities in outlook.

The Massachusetts Institute of Technology (MIT), by virtue of its size and stature, is surely a leading symbol of science and technology. And it has often expressed its recognition of the significance of the humanities. But it is interesting to read what William Irwin Thompson, who did time at MIT, writes in his widely acclaimed book, *At the Edge of History*: 'What distinguished MIT from any other university was not its science but its overwhelming lust for power . . . When men are trained to strive for power over their environment they are socially constrained to achieve that success through suppression of consciousness in which ambiguity, complexity, feeling, intuition and imagination are dismissed as irrelevant distractions . . .

'The humanist at MIT thus finds himself in a situation that is no doubt prophetic of the condition of the citizen in the technological society of A.D. 2000. To the degree that the humanist succeeds in technologizing the humanities (by turning them into the social sciences), he destroys the humanities; to the degree that he ignores the technological world and teaches as one might at Cardinal Newman's Oxford, he insures the conviction in his students' minds that the humanities are simply irrelevant to the mastery of our new complex society; to the degree that he succeeds in communicating the relevance of the traditional humanities to our society, he finds himself welcomed by the administration as valuable camouflage, and resented by his students, who correctly point out that while he makes a great noise, he is still powerless to affect the inhumane training of the whole Institute. The naive humanist thinks that in teaching the humanities to MIT students he is helping a major American institution deal with the problems of our civilization, but it does not take long for the students to educate the teacher to see that the Institute is, as Eldridge Cleaver would say, not part of the solution, but part of the problem.'

I do not know how just this trenchant critique may be, but it is of great interest as a humanist's reaction to a great technical institute. (In *Technology Review* for May 1975, Bruce Mazlish, the new head of the humanities department at MIT, presented an alternative: 'Another role . . . is for the Department to become integrated into the full intellectual life and work of the Institute, to become involved with the people in engineering and science in trying to understand problems that are related to the creation of a new kind of world by science and technology . . . in some ways, in the future the only way you'll be able to do good science or

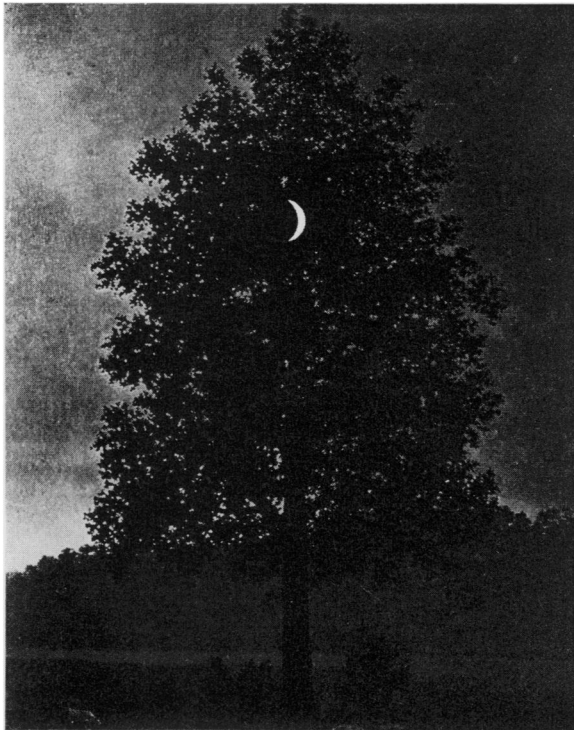


Fig. 1. Rene Magritte. 'September 16'.

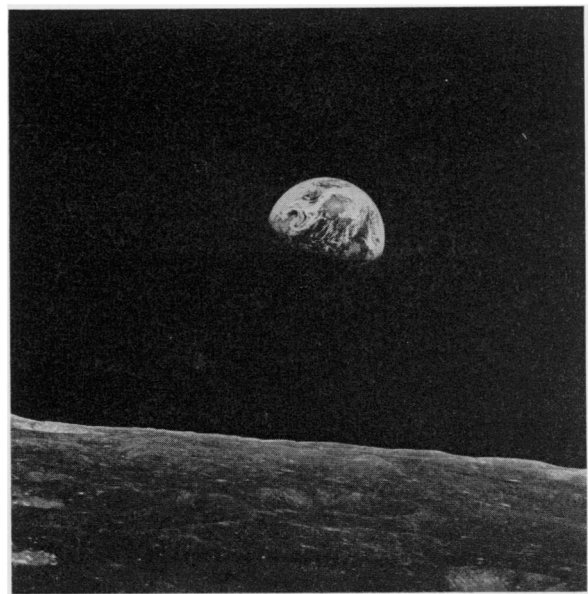


Fig. 2. View of the Earth from the Moon

technology is by having a very keen awareness of the humanistic and social science component.)'

Thompson, however, has a real point. The problem is, if I may borrow a term from the social scientists, one of 'role models.' It would do little good simply to inject more required humanities courses into the Caltech or MIT curricula. The student comes to Caltech or MIT to become a scientist or engineer; his models, then, are inevitably the great scientists and engineers who are his mentors. If they ignore the humanities—if they, as they do, make it clear that pure physics, or chemistry or biology or mathematics, is the real focus of interest and the locus of importance, then all the wisdom of the humanists will leave scant imprint. To impress the student with the importance of nonscience he must see that his role models are concerned with nonscience. The questions of the social consequences of science and technology, the issues of choice and values, must be brought into the physics and chemistry and biology classrooms so that as the student learns the physics of splitting the atom, he also ponders the social correlates of nuclear fission. And as he

learns the principles of genetics, he also learns of the reality of environmental mutagens and ponders the significance of innate human diversity.

I do not pretend that I know how to bring this about—but I do believe that we need sorely to develop an educational style that will prepare our best students to cope with the problems of whether and which, as well as how. When we have accomplished that, perhaps we will see more clearly the relation between science and humanities that I feel is depicted in the famous photograph from Apollo 8 of our earth rising over the lunar horizon (Fig. 2).

Here, the power of science has provided us with a simple, dramatic confirmation of the ancient humanist vision of the common bond, the common solitude, the common destiny of all mankind on this small Eden floating in the vastness of space.

The vision of the scientist need not eclipse that of the humanist—nor vice versa. Rather they should complement and reinforce each other as we find our way into the future.